TOPOGRAPHIC AND STRATIGRAPHIC ANALYSIS OF TWO VENUSIAN VOLCANIC RISES: WESTERN EISTLA AND BELL REGIONES.

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Abstract. The comparative global hypsometric analysis of Earth and Venus has revealed that the global topographic pattern of Venus could be related to hot spot-dominated mantle dynamics (1). In addition, the variations of topographic and gravimetric properties of the venusian volcanic rises have been interpreted as resulting from differing stages of evolution (2). In an attempt to understand Venus' tectonics in hot spot dynamics and temporal context, the topographic and tectonic characteristics of the volcanic rises of Western Eistla and Bell Regiones have been studied, on the basis of the mapping of geological units.

Tectonics vs elevation. Evidence of topographic uplift has been found associated with tilted Tesserae blocks, just East of Western Eistla Regio. These blocks are tilted from rolling plains toward lowlands areas, which are located at the eastern boundary of Eistla rise. Evidence of downwarping is observed as a narrow band (about 400 Km) of wrinkle ridges oriented North-South and more closely spaced (about 16 Km) than the regional set (about 25 Km) which is oriented East-West. This anomalous band of wrinkle ridges corresponds very well to the lowlands areas located at the eastern boundary of Eistla Regio. These ridges could be formed as a consequence of a local subsidence. In a hot spot dynamics context, this subsidence could be related to the downwelling mantle flow which is the counterpart of the upwelling flow assumed to be at the origin of the topographic rise of Western Eistla. Volcanism is widespread at all elevations but with different morphologies. The lowlands are covered by volcanic plains, deformed by wrinkles ridges. Such plains are also present in rolling plains domain along with volcanic plains densely fractured in an extensional tectonic regime. Another volcanic landform is mainly observed in rolling plains and correspond to shield field volcanoes. At highlands, volcanism is specific and characterized by large volcanoes, located at the top of the topographic rise. The associated lava flows also mainly lie in highlands and form volcanic lobate and smooth plains.

Tectonic observations reveal that specific deformation and volcanism correspond to lowlands and highlands, respectively. In addition types of volcanism is present within each topographic domain but is associated with different landforms.

Stratigraphy vs elevation. The mapping of the geological features corresponding to stratigraphic units permits mapping of the topographic distribution of each unit. Tesserae, which are the oldest unit in the global stratigraphy scale of (3), are mainly lying in the rolling plains domain. This latter domain is mainly associated with old units: Volcanic plains densely fractured and shield field volcanoes. Younger volcanic plains deformed by wrinkle ridges are mainly lying in lowlands. The youngest units, corresponding to volcanic lobate or smooth plains, are mainly lying in the highlands. A careful analysis of stratigraphic relationships between both regional East-West and local North-South wrinkle ridges sets reveals that the local set is younger than the regional one. Thus, based on the global stratigraphic scale, the specific deformation observed at lowlands is amongst the more recent deformations at Venus.

Stratigraphic observation reveal that the more recent volcanism is lying at highlands (above 6052.8 Km) while more recent deformation is lying at lowlands (below 6051 Km). Older tectonism and volcanism are lying within rolling plains.

Preliminary Interpretations (toward a temporal evolution of venusian hot spots). The tectonic, stratigraphic and elevation relationships yield some interpretation for the temporal aspect of tectonics of venusian hot spots.

The old tectonism and volcanism are not correlated with mantle plume activity. Only recent tectonism, at lowlands, and recent volcanism at Highlands are associated with recent mantle plume activity in the history of Venus.

Stratigraphic relationship between Western Eistla and Bell Regiones. The percentage of area of each stratigraphic unit reveals that, at Bell, the main surface is covered by young units while, at the north part of Western Eistla, it is covered by old units (figure 1). The older surface of Western Eistla does not mean that the associated hot spot is older than the one associated with Bell Regio, but rather that Eistla hot spot did not get sufficient time to produce broad volcanic resurfacing. This interpretation is only valid if Western Eistla and Bell hot spots follow the same sequence of temporal evolution. Nevertheless, such an interpretation is in accordance with those from both topographic and gravimetric observations and numerical simulations of mantle plumes/lithosphere interaction (4)

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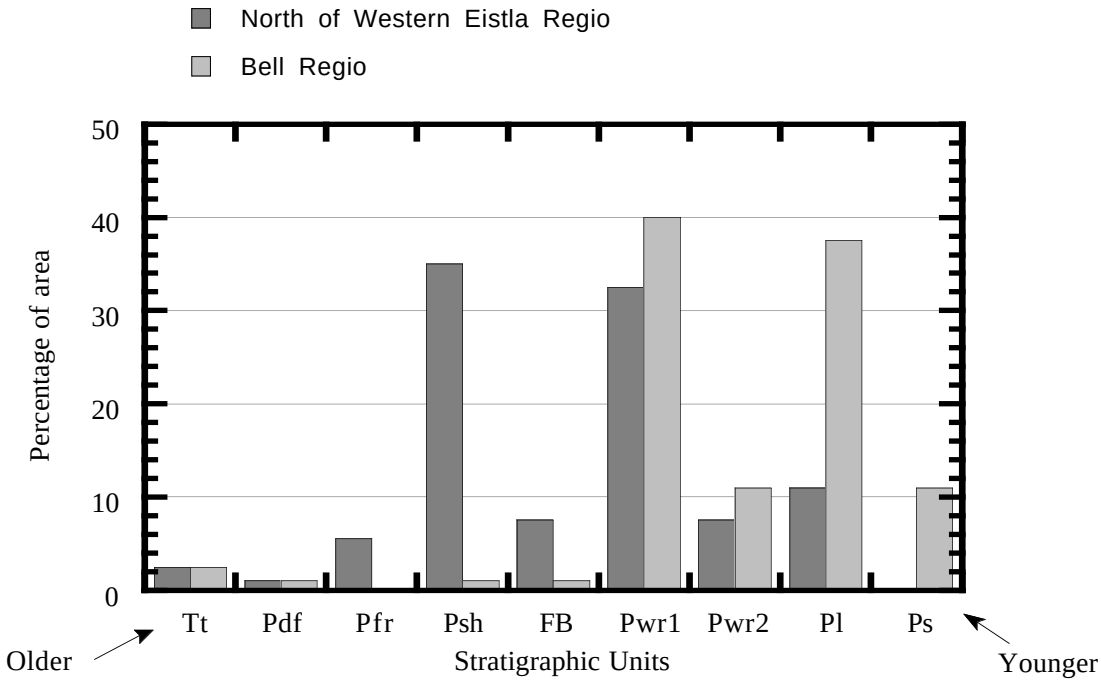

Figure 1: Hypsometry of stratigraphy of the north part of Western Eistla and Bell regiones.